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NATIONAL BUREAU OF STANDARDS

Technical News Bulletin

UNITED STATES DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

Technical News Bulletin

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COVER: *Time-exposure photograph depicting natural convection in a small air space. The streaklines indicate the motion of tracer particles (metaldehyde) suspended in the air.* (*See page 292.*)

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The National Bureau of Standards serves as a focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. For this purpose, the Bureau is organized as follows:

- The Institute for Basic Standards
- The Institute for Materials Research
- The Institute for Applied Technology
- Center for Radiation Research
- Center for Computer Sciences and Technology

The TECHNICAL NEWS BULLETIN is published to keep science and industry informed regarding the technical programs, accomplishments, and activities of NBS.

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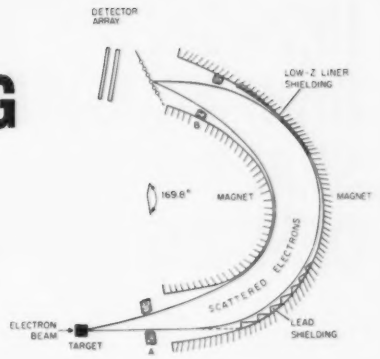
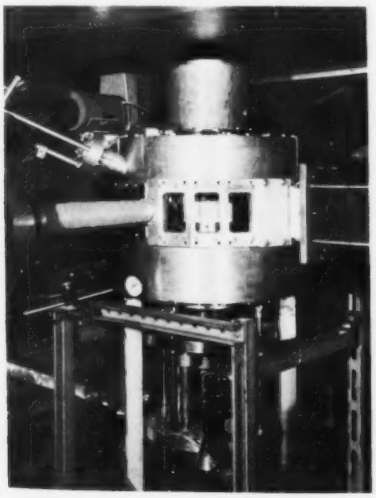
A LOOK AT THE NUCLEUS USING ELECTRON SCATTERING



Schematic of the electron scattering spectrometer and detector system. Electrons scattered from the target material pass through aperture A and are focused by a magnet onto the detector array after passing through B. Internal background of scattered high energy electrons is reduced by lining the outside-internal wall of the deflecting magnet with lead shielding and a low-Z material.

AN ELECTRON SCATTERING TECHNIQUE [1] is providing physicists at the Bureau with knowledge of some basic properties of the atomic nucleus. To make nuclear measurements, an electron scattering spectrometer, developed by Samuel Penner, John W. Lightbody, Jr., and Sherman P. Fivozinsky of the Linac Radiation Division, is used in conjunction with the NBS electron linear accelerator.[2] Besides the Bureau researchers, several guest scientists from the Massachusetts Institute of Technology, the University of Maryland, Catholic University, American University, Virginia Polytechnic Institute, and the Laboratoire de l'Accelerateur Lineaire, Orsay, France, are engaged in experimental studies at this facility to measure nuclear radii and determine detailed properties of excited nuclear states. To date, the target materials investigated include carbon-12, oxygen-16, fluorine-19, calcium-40, titanium-48, strontium-88, yttrium-89, and zirconium-90.



Electron scattering chamber at the NBS Linac. Bullseye, seen through open port, is used to aline the electron beam (enters through tube at left) with a target. Scattered electrons enter the spectrometer at right.

When a material is bombarded with electrons, the majority of these electrons interact with the electrons surrounding the nucleus of each atom (atomic scattering). However, a very small number of electrons pass through the surrounding electrons and strike the atom's nucleus. The interaction between the incident electrons and the nucleus is of particular interest in these studies. To reduce the sensitivity to atomic scattering effects, the materials are bombarded with electrons having very high energies—millions of electron volts (MeV).

The theoretical model of the electron-nucleus interaction assumes a nucleus that is distributed in space, and that impinging electrons act as waves of energy rather than as particles. In a manner analogous to optical diffraction, the electrons striking the nucleus are deflected from it at various angles and with varying intensities to form a diffraction pattern characteristic of the nuclear size. During some electron-nucleus interactions, the electron loses energy to the nucleus via inelastic scattering, leading to excited nuclear states. The types of nuclear excitation produced are analyzed by studying the momentum transfer dependence and angular distribution of the scattered electrons.

The experimental technique used to investigate electron-nucleus interactions is to direct a highly resolved electron beam (energy resolution of 0.1 percent) onto a target, at incident energies ranging from 20 to 130 MeV. A magnetic spectrometer then accepts electrons scattered from the target and analyzes them according to their momentum. The electrons are detected by a focal plane array of 20 small, solid-state detectors, which are backed by two scintillator detectors for coincidence counting. The final output is a display of the number of scattered electrons per unit energy per incident electron plotted versus the energy of the scattered electron.

From the electron energy spectra, some basic properties about nuclear structure can be derived. These include the nuclear radius and such detailed properties of excited nuclear states as the spin, parity, and transition strength. The determination of these properties provides experimental tests of existing theoretical models.

[1] For further details, see Penner, S., **Experimental Techniques for Electron Scattering Investigations**, Nat. Bur. Stand. (U.S.), Tech. Note 523, 46 pages (Apr. 1970), for 50 cents. Order by SD Catalog No. C13.46:523.

[2] Penner, S., **Beam Handling Techniques for Electron Linear Accelerators**, Nat. Bur. Stand. (U.S.), Tech. Note 522, 21 pages (Apr. 1970), for 30 cents. Order by SD Catalog No. C13.46:522.

Both of the above publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, or from any U.S. Department of Commerce Field Office. Also available from the National Technical Information Service, Springfield, Va. 22151, as NBS TN-523 (reference 1) or NBS TN-522 (reference 2).

IMPROVED HIGH-VACUUM SEALS DEVISED

MODULAR COMPONENTS WITH IMPROVED SEALS,[1] suitable for use in high-vacuum systems, have been devised at the NBS Institute for Basic Standards. In this work by R. L. Anderson, L. A. Guildner, and R. E. Edsinger, special techniques were devised for making seals with gaskets of certain fluorocarbons, which reduce contamination from outgassing and permeation. Systems constructed from such modular components are capable of being pumped down to 10^{-7} torr (1 torr = 1.33×10^{2} N/m^2), with no detectable leaks at a level of 2×10^{-10} cm^3/s of helium.

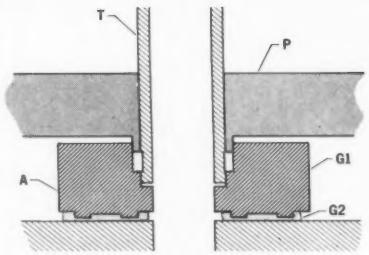
Assembly of vacuum systems from commercial components typically requires that tubes be welded or soldered to flanges, which are then sealed with elastomer "O-ring" gaskets. These gaskets usually require the presence of grease to seal and are generally an additional source of contamination because most "O-ring" materials desorb gas and are permeable. The use of TFE (polytetrafluoroethylene) "O-rings" avoids the latter problem, but seals formed by them are not always reliable. Other types of commercial vacuum joints involve sealing by deformation of metal ferrules or gaskets, which can be reused, at most, only a few times.

TFE or CFE (polytrifluorochloroethylene) are used as the sealing materials in the NBS devices. Gaskets made from these polymers have two desirable properties for a high-vacuum system: First, under vacuum, the materials evolve gas at a rate per unit surface area that is initially less than stainless steel, and then falls substantially with continued pumping; and second, under sufficient pressure to produce flow, both TFE and CFE are impervious to the gases normally encountered in vacuum work.

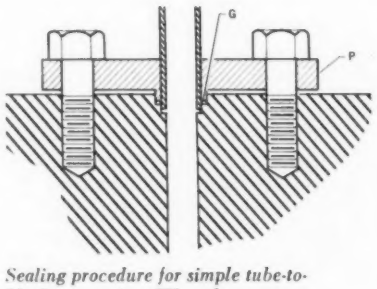
At pressures above the yield point (3000 psi or 20.7 MN/m^2 for TFE, and 5000 psi or 34.6 MN/m^2 for CFE), the polymers behave like highly viscous fluids. As flow of these materials is inelastic, they will seal to surfaces of relatively poor quality. Successful performance of vacuum seals employing these materials is achieved by exerting enough pressure on the gasket material to exceed the yield point, maintaining this pressure, and confining the flow of the material to the sealing region. The first two conditions are met in most of the designs by spring loading the seal with a flexed metal bar. To avoid excessive flow out of the sealing region, parts are fabricated so that clearances do not exceed 0.025 mm.

A family of devices—vacuum plumbing connectors such as elbows, unions, tees, and caps; movable joints such as cylinder joints, ball-and-socket joints, and valves; and special joints made of "land-and-groove" seals—make it easy to assemble or modify vacuum systems without welding or soldering. Such seals may be made repeatedly and yet retain the reliability and high-vacuum quality necessary to meet severe requirements of the NBS Precision Manometer[2] and of the NBS Gas Thermometer.

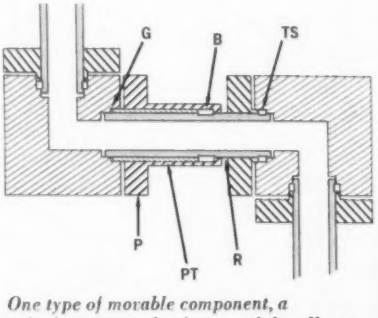
Cylinder joints, ball-and-socket joints, and valves all have parts that move. With its low coefficient of friction, TFE can be used to seal moving parts in these components with relative ease while remaining vacuum tight (even in motion). On the other hand, some joints should not move. Against moderate forces, the higher coefficient of friction of CFE will suffice to immobilize sealed parts. For large forces, use of CFE in conjunction with a retaining groove is very successful in clamping the parts.



Two types of seals are illustrated, a lock gasket G1 *and a land-and-groove seal* G2. *The land-and-groove seals have wide application, such as sealing lids to vacuum chambers.*



Sealing procedure for simple tube-to-block connection. When the screws are tightened until sufficient force is applied by the flexed metal bar P *to exceed the yield point of a TFE gasket* G, *the gasket flows and creates a seal between the tube and the block.*



One type of movable component, a cylinder joint made of two modular elbows and adapter parts. The rotating tube R *is made with a notch to lock it to the elbow on the right by a CFE seal* TS, *and with another notch for a TFE bearing* B. *Force is applied by the pusher* P *to* B *and by the coaxial pusher tube* PT *to a TFE seal* G.

[1] Anderson, R. L., Guildner, L. A., and Edsinger, R. E., Movable and fixed modular vacuum devices with confined fluorocarbon plastic seals, Rev. Sci. Instr. 41, No. 7, 1076–1082 (1970).

[2] Guildner, L. A., Stimson, H. F., Edsinger, R. E., and Anderson, R. L., Metrologia 6, No. 1, 1–18 (Jan. 1970).

INTERNATIONAL INTERCOMPARISON OF NEUTRON FLUX DENSITIES

THERMAL NEUTRON FLUX DENSITY is a quantity quite important in the calibration of neutron detectors. The Bureau played a major role in the first international intercomparison of thermal neutron flux densities conducted under the auspices of the International Bureau of Weights and Measures. Eleven laboratories* participated in the effort, each being provided with a new value based upon the results of a computation incorporating the laboratory's own value weighted with the values determined by other laboratories. This intercomparison was based on the premise that each lab unknowingly incorporates systematic errors into its values that would be detected by a round-robin intercomparison. As a result of the program, many laboratories including NBS modified the value of their flux standard, adopting the international "best" value.

The results of the intercomparison were analyzed and reported by Randall S. Caswell and William M. Murphey of the NBS Center for Radiation Research [1] and E. J. Axton of the National Physical Laboratory, Teddington, England.[2] The program was initiated through mutual agreement of the laboratories upon the suggestion of the Neutron Working Group of the Bureau International des Poids et Mesures of which Drs. Axton and Caswell are members. Nearly all laboratories agreed with the international mean value within an uncertainty of about 1.5 percent, the extreme deviation being 2.6 percent.

The measurements were made by irradiating gold foils with a standard thermal neutron flux. Most of the laboratories irradiated at least three foils, measured their activity, and then sent the foils to several other participating labs for counting. The irradiation and counting techniques varied from lab to lab, and the uncertainties of the separate determinations of any one lab's neutron flux density ranged from 0.8 to 2.2 percent.

The NBS procedure for irradiation was to place thin, circular gold foils within a cavity located between two Ra-Be(α,n) radioactive neutron sources. The foils were left in the cavity for periods of about a week or the time equivalent for the production of two to three half-lives.

Following irradiation Mr. Murphey and Harold L. Steinberg determined the amount of low-level, gamma radiation emitted by the foils using a 3-inch NaI(Tl) well crystal. [The gamma radiation can be directly related to the neutron flux.] The same procedure was applied to all the foils irradiated at the other laboratories and sent to NBS for counting.

*The participating laboratories were: the National Bureau of Standards; National Physical Laboratory; Australian Atomic Energy Commission; A. B. Atomenergi, Sweden; Atomic Energy Establishment, Trombay, India; C.E.N. de Fontenay-aux-Roses, France; Electro-technical Laboratory, Japan; Mendeleev Institute for Metrology, U.S.S.R.; International Atomic Energy Agency, Austria; National Research Council, Canada; and the Physikalisch-Technische Bundesanstalt, Germany.

[1] For further details, see Murphey, W. M., and Caswell, R. S., Analysis of results of the Bureau International des Poids et Mesures thermal neutron flux density intercomparison, Metrologia (in press).

[2] Axton, E. J., Results of the intercomparisons of the thermal neutron flux density unit (1966–1968), Metrologia 6, No. 1, 25–32 (1970).

Patrol car supplies data for NBS brake research.—Officer R. A. Walton of the Washington (D.C.) Metropolitan Police Force drives his patrol car on Washington's Florida Avenue as NBS technician Harold Shankle checks operation of a system monitoring the car's brake temperatures on a small recorder next to the dashboard. The Bureau is measuring brake temperatures in various kinds of service to determine requirements for braking systems and components for the Department of Transportation. Shankle has installed sensors and recorders on commuters' cars. Commerce Department personnel shuttles, police cars, post office delivery vehicles, and cars on a cross-country trip. Findings will help identify how severe actual brake performance requirements are.

NBS APPOINTS NEW INSTITUTE AND CENTER DIRECTORS

Institute for Applied Technology

The new Director of the Institute for Applied Technology is Dr. F. Karl Willenbrock, widely known engineer and educator. Dr. Willenbrock comes to NBS from the State University of New York, at Buffalo, where he was Provost and Professor of Engineering and Applied Sciences. During the 6 months before joining NBS he served as Special Advisor for Engineering Education to the Chancellor of the State University Systems.

In his new post he will direct the Institute in a range of activities with broad implications for many of the Nation's leading problems, such as consumer protection programs; voluntary industrial standardization procedures; development of research and performance standards for electronic technology, building technology, vehicle systems, paper and textile technology; technical work on toy safety standards; fire research and safety; flammable fabrics; policy studies on means of encouraging invention and innovation; and provision of a central basis for weights and measures in all the 50 States.

Educated at Brown University (Sc. B., electrical engineering, 1942) and Harvard University (A.M., applied physics, 1947, and Ph. D., electron physics, 1950), he went on to serve at Harvard as a faculty member, 1950–1967, Director of Laboratories, 1960–63, and Associate Dean of Engineering and Applied Physics, 1960–67. He has served as a consultant to a number of industrial organizations, Federal agencies, and other universities. In 1962, he was awarded the Distinguished Engineering Award of Brown University.

A member of many professional societies, Dr. Willenbrock has been particularly active in the Institute of Electrical and Electronics Engineers, serving as Vice-President for Publications in 1966–68 and as President in 1969. He is presently a member of the Board of Directors of IEEE. He headed a delegation of engineers to the Soviet Union, visiting laboratories and industrial organizations in Moscow, Leningrad, and Novosibirsk, and represented the United States as a member of the seven-man delegation to the Second World Congress of the World Federation of Engineering Organizations in Paris. Dr. Willenbrock has chaired and served on National Science Foundation panels and was appointed recently to a 4-year term as a member of the Foundation's Science Information Council.

Center for Computer Sciences and Technology

Dr. Ruth M. Davis is the new Director of the Bureau's Center for Computer Sciences and Technology (CCST). A major function of the Center is implementation of the Brooks Bill (Public Law 89–306). This law, and supporting policy guidance from the Office of Management and Budget, assigns to NBS the responsibility for:

- providing guidance in the promulgation of hardware and software standards, both for industry-wide voluntary standards and Federal standards,
- providing other Government agencies with technical assistance and consultation in both hardware and software areas for the efficient use of computers,
- promoting training in various areas of computer applications,
- providing information services related to computer technology,
- providing computer services—involving the use of both equipment and programming—to NBS and to other government agencies, and
- engaging in exploratory research.

In addition, CCST is a national center for research and development for the Government in the broad fields of computer sciences and technology.

Dr. Davis comes to NBS from the National Library of Medicine, of the National Institutes of Health, Department of Health, Education, and Welfare, where she was Director of the Lister Hill National Center for Biomedical Communications and Associate Director for Research and Development.

Before her position at HEW, Dr. Davis served as Staff Assistant to the Special Assistant (National Intelligence), Department of Defense; and as Head, Operations Research Division, Applied Mathematics Laboratory, David Taylor Model Basin, Navy Department. She also served as Consultant to the Republic of China on the use of management information systems. She is Visiting Professor of Computer Sciences at the University of Pittsburgh, taught programming for electronic digital computers at the University of Maryland Graduate School, and continues to lecture at several other universities.

She is author of dozens of technical papers, articles, and reports; is a member of more than 10 honorary or professional societies; and has many honors, awards, commendations, and fellowships for outstanding achievements.

FIPS NOTES

In the fall of 1965 the Secretary of Commerce established the NBS Center for Computer Sciences and Technology to carry out the Secretary's responsibilities under the Brooks Bill (Public Law 89–306, passed October 30, 1965). The Center provides leadership and coordination for Government efforts in the development of voluntary commercial information processing standards, develops recommendations for Federal information processing standards, performs required research and analysis, and provides scientific and technical support and consultative assistance in the field of computers and information processing to Federal agencies. These Notes will cover information-processing standards activities in the Federal Government, particularly those of the Center.

TAPE CASSETTE STANDARDIZATION

As a result of a recent letter ballot by ANSI Standards Committee X3, Computers and Information Processing, approval was given to initiate work leading to standards for recording digital information on magnetic tape cassettes. The standards development is to include considerations of the cassette container, the tape, recording characteristics, and recording format. Initially, the standards work will concentrate on defining the necessary performance characteristics such as the length of tape and tape speed.

Within the X3 Committee structure, the cassette standardization work was assigned to X3B1 (formerly X3.2.1), Magnetic Tape, which is chaired by A. J. Burkhart, Jr., of the General Services Administration (GSA).

Those interested in information concerning this work may contact Mr. Burkhart at the GSA Magnetic Tape Laboratory, Room A109, Technology Building, National Bureau of Standards, Washington, D.C. 20234.

MODIFICATION TO PROPOSED STANDARD FOR IDENTIFICATION OF INDIVIDUALS

The June 1970 issue of the *NBS Technical News Bulletin* reported on a proposed standard for the identification of individuals for information interchange.[1] As a result of thorough review by the various interested subcommittees of the ANSI X3 Committee, an error was revealed in the proposal that created an ambiguity in interpretation. The proposal was returned to the X3L8.3 Committee for correction. The error has been corrected, resulting in the following effect:

An additional comma will be inserted between the middle name of the individual and the field termination character (slant or virgule "/"). An example of the standard identifier as recently modified would be:

232-48-1847 Johnson, William, Robert,/

(Previously there was no comma after "Robert.")

Copies of the proposed standard may be obtained from the Business Equipment Manufacturers Association, BEMA/STDS, 1828 L Street NW., Washington, D.C. 20036. Refer to document X3.8/128 (Revised June 1970).

STATE AND COUNTY CODES

Proposed standards for coding the States and Counties of the United States have been forwarded to the ANSI X3 Committee by Subcommittee X3L8 (formerly X3.8), Representations of Data Elements. The County Codes proposed as American National Standards are identical to those contained in FIPS PUB 6–1, Counties and County Equivalents of the States of the United States[2] (45 cents, SD Catalog No. C13.52:6–1).

With the exception of the outlying areas of the U.S., the proposal forwarded by X3L8 is identical to the

Codes listed in FIPS PUB 5–1, States and Outlying Areas of the United States [2] (20 cents, SD Catalog No. C13.52:5–1). Codes for the outlying areas are not included in the proposed American National Standard, but will be included in the list of Country Codes now under development in the X3L8.3 Task Group.

After public announcement of the proposed standards, the members of X3 will vote by letter ballot as to the acceptability of the proposed standards as American National Standards. Copies of the proposed standards may be obtained from the Business Equipment Manufacturers Association, BEMA/STDS, 1828 L Street NW., Washington, D.C. 20036. Refer to documents X3L8/165 (Counties) and X3L8/141 (States).

STANDARD POINT LOCATION CODE (SPLC)

The Board of Directors of the Transportation Data Coordinating Committee [3] (TDCC) has endorsed the adoption and use of a Standard Point Location Code (SPLC) and has recommended that it become the uniform geographic point identification code throughout the transportation/distribution community.

The Standard Point Location Code was developed as a joint project of the American Trucking Association and the Association of American Railroads with the assistance of the Transportation Division, Bureau of the Census. The first version of the SPLC appeared in 1966 and was revised to the current version in 1968. The SPLC also appears in the Association of American Railroads' Freight Station Accounting Directory, and beginning on April 24, 1970, the SPLC has appeared in the computerized National Rate Basis Tariff. To date, more than 350 major manufacturers and transportation carriers (meaning railroads, truckers, airlines, and inland waterways) have subscribed to and are using the SPLC. Within the next year the standard is expected to be fully implemented by the transportation community.

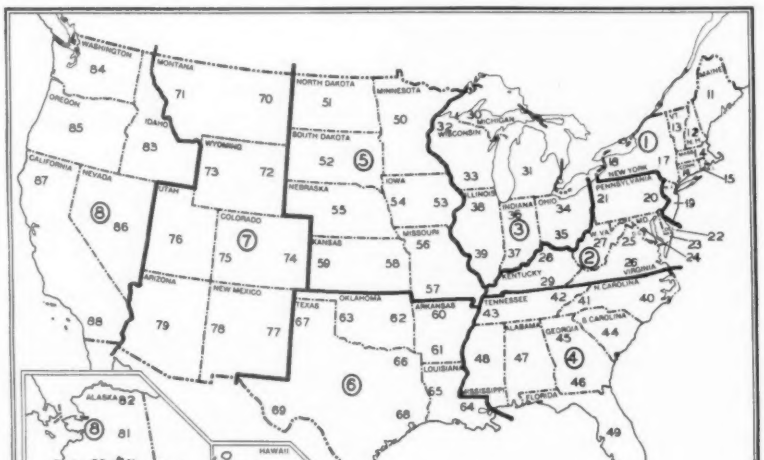
The definition criteria for the inclusion of a point in the SPLC list is that it be any named political subdivision of the United States, Canada, or Mexico, or any recognized named traffic location used by the transportation community. The Transportation Data Coordination Committee acts as a central coordinator for the assignment of codes to new points and also maintains the SPLC from the standpoint of validity and currency.

The SPLC is a six-digit code composed of three sets of paired numbers.

MARYLAND — STANDARD POINT LOCATION CODE — MARYLAND

POINT	COUNTY	SPLC	POINT	COUNTY	SPLC
Holbrook	Baltimore	2322 82	Jasontown	Carroll	2327 19
Holiday Beach	Calvert	2391 16	Jefferson	Frederick	2333 85
			Jefferson Heights	Washington	2334 67
Holland Point	Calvert	2391 78	Jenkins	Baltimore	2321 89
Hollins	Baltimore	2323 22	Jennings	Garrett	2338 22
Hollofield	Howard	2363 25			
Hollywood	Saint Marys	2397 39	Jerusalem	Harford	2315 49
Hollywood <College Park>	Prince Georges	2377 30	Jessup <Jessups>	Howard	2363 89
			Jessups	Howard	2363 89
Hollywood Park	Montgomery	2374 54	Jesterville	Wicomico	2384 94
Homeland <Baltimore>	IC	2340 00	Jewell	Anne Arundel	2368 97
Homewood	Allegany	2339 44			
Honga	Dorchester	2382 76	Jimtown	Frederick	2332 38
Hood	Washington	2334 08	Johnsontown	Kent	2317 24
			Johnstown	Carroll	2328 76
Hoods Mill	Carroll	2328 94	Johnstown	Calvert	2391 95
Hoopersville	Dorchester	2382 78	Johnsville	Frederick	2332 23
Hope	Queen Annes	2351 54			
Hopeland	Frederick	2333 39	Jones	Anne Arundel	2368 13
Hopewell	Somerset	2388 35	Jonestown	Howard	2363 14
			Joppa	Harford	2315 87
Houcksville	Carroll	2327 73	Joyce	Anne Arundel	2368 22
Howard Park <Baltimore>	IC	2340 00	Jugtown	Washington	2334 39
Howardville	Baltimore	2323 23			
Hoyes	Garrett	2338 21	Jumptown	Caroline	2354 35
Hughesville	Charles	2394 36	Kaese Mill	Garrett	2338 24
			Kalmia	Harford	2315 51
Humgerford Towne <Rockville>	Montgomery	2373 70	Keedysville	Washington	2334 69
Huntersville	Saint Marys	2397 18	Keller	Frederick	2333 25
Hunting Hill	Montgomery	2373 85			
Hunting Ridge <Baltimore>	IC	2340 00	Kempton	Garrett	2338 97
Huntingtown	Calvert	2391 35	Kemptown	Frederick	2333 65
			Kenilworth Park <Baltimore>	IC	2340 00
Hurlock	Dorchester	2382 20	Kennedyville	Kent	2317 44
Hurry	Saint Marys	2397 61	Kensington	Montgomery	2374 10
Hursley	Worcester	2386 87			
Hutton	Garrett	2338 57	Kensington Estates	Montgomery	2374 12
Huyett	Washington	2334 38	Kensington Heights <Wheaton>	Montgomery	2374 20

A typical page from the alphabetical SPLC listing that reflects point name, county location of point, and code. If a point is part of a large place, the larger place is enclosed by "< >"s.



SPLC Regional Group of States

The United States is divided into regions numbered "1" on the East Coast, to "8" on the West (figure 1); "0" is reserved for Canada and "9" for Mexico. Each region is further subdivided into States, or parts of States. In turn, the States are divided into county units. The SPLC code yields region and state identification, county identification, and a particular point within the county. The first two digits (high order) of the code identify a State, a State section, or a territory. The third and fourth digits identify a county (or its equivalent) or section thereof. The fifth and sixth digits identify a point. Each county or portion of a county is capable of being divided into as many as 100 areas to identify as many as 100 points.

Over 100 000 points have been identified and coded. This number, compared to other coding schemes, is by far the most complete in its coverage. The ZIP Code used by the Post Office Department to identify post offices includes some 40 000 entities, and the list developed by the General Services Administration for use in accounting systems for Federal property contains some 20 000 places.

Recently, files have been constructed that associate longitude and latitude for the places identified in the SPLC. These files are used to determine airline distances between points and for other statistical purposes.

Copies of the Standard Place Location Code books and also magnetic tapes that include SPLC information are available from the National Motor Freight Traffic Association, Tariff Research Section, 1616 P Street NW., Washington, D.C. 20036. The Code book, which lists the places alphabetically by State (figure 2), is available for $25. Reduced rates are in effect for additional copies when ordered in multiples. The magnetic tape, which is 7-track, BCD coded, 556 bits per inch, is available for $50. The tapes are loaned to the subscriber and are returned to the National Motor Freight Traffic Association after they have been duplicated.

COMPUTER CAREERS

The Business Equipment Manufacturers Association (BEMA) in cooperation with the American Federation of Information Processing Societies has prepared a 24-page brochure describing career opportunities available within the computer industry. The many different jobs relating to the computer are discussed. Also included is a table that provides salary information on the many careers within the industry. Copies of the brochure may be purchased from BEMA, 1828 L Street NW., Washington, D.C. 20036, for 40 cents. Discounts are available on quantity orders.

STATUS OF FEDERAL INFORMATION PROCESSING STANDARDS

Development Phase

FORTRAN Programming Language
Government Agency Codes
Hardware Interfaces
Interchangeable Magnetic Disk Media
Keyboard Configuration
Magnetic Tape Labels for Information Interchange
Numerical Machine Control Perforated Tape
OCR Paper
OCR Print Quality
One-Inch Perforated Paper Tape for Information Interchange
Parallel Signaling Speeds for Data Transmission
Recorded Magnetic Tape for Information Interchange (200 cpi, NRZI)
Signal Quality at Interface Between Data Processing Terminal Equipment and Synchronous Data Communication Equipment for Serial Data Transmission
Signaling Speeds for Data Transmission
Synchronous Signaling Speeds
Take-Up Reels for One-Inch Perforated Paper Tape
Time Sharing and Remote Console Considerations
Unrecorded Magnetic Tape for Information Interchange

Coordination Phase

COBOL Programming Language
Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange
Interface Between Data Terminal Equipment for Data Communication Language Codes
Layout of Forms for OCR Input
Recorded Magnetic Tape for Information Interchange (1600 cpi, Phase Encoded)
Specifications for General Purpose Paper Cards for Information Interchange

Submitted to Office of Management and Budget for Approval

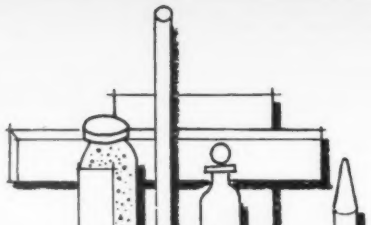
Bit Sequencing of the Code for Information Interchange in Serial-by-Bit Data Transmission
Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication
Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication in the Code for Information Interchange
Hollerith Punched Card Code
Rectangular Holes in Twelve-Row Punched Cards
Subsets of the Standard Code for Information Interchange
Vocabulary for Information Processing

Issued Standards and Related Publications [4]

FIPS PUB 0 General Description of the Federal Information Processing Standards Register
FIPS PUB 1 Code for Information Interchange (FIPS 1)
FIPS PUB 2 Perforated Tape Code for Information Interchange (FIPS 2)
FIPS PUB 3 Recorded Magnetic Tape for Information Interchange (FIPS 3)
FIPS PUB 4 Calendar Date (FIPS 4)
FIPS PUB 5–1 States and Outlying Areas of the United States (FIPS 5–1). Revision of FIPS PUB 5 and FIPS 5
FIPS PUB 6–1 Counties and County Equivalents of the States of the United States (FIPS 6–1). Revision of FIPS PUB 6 and FIPS 6
FIPS PUB 7 Implementation of the Code for Information Interchange and Related Media Standards (Supplement to FIPS 1, 2, and 3)
FIPS PUB 8 Metropolitan Statistical Areas (FIPS 8)
FIPS PUB 9 Congressional Districts of the United States (FIPS 9)
FIPS PUB 10 Countries, Dependencies and Areas of Special Sovereignty (FIPS 10)

[1] See FIPS Notes, NBS Tech. News Bull. 54, No. 6, 133–135 (June 1970).
[2] Order by SD Catalog Number from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for the price indicated.
[3] See FIPS Notes: Transportation data standards, Nat. Bur. Stand. (U.S.), Tech. News Bull. 54, No. 8, 187 (Aug. 1970).
[4] Procedures for purchasing copies of FIPS PUB's may be obtained from the NBS Office of Technical Information and Publications, Room A607, Administration Building, Washington, D.C. 20234. Refer to NBS LP 58.

STANDARD REFERENCE MATERIALS



Standard Reference Materials are well-characterized materials certified for chemical composition or for a particular physical or chemical property. These materials are disseminated by NBS to be used to calibrate and evaluate measuring instruments, methods, and systems or to produce scientific data that can be referred readily to a common base.[1]

CATALOG OF STANDARD REFERENCE MATERIALS

Catalog of Standard Reference Materials[1] (75 cents, SD Catalog No. C13.10:260) is a revised edition of the publication that lists the various Standard Reference Materials (SRM's) now being distributed by the Bureau. These materials are used to calibrate measurement systems and to provide a central basis for uniformity and accuracy of measurement. The unit and quantity, the type, and the certified characterization are listed for each material, as well as directions for ordering. New and renewal materials are announced in the *Technical News Bulletin* and in scientific and trade journals; and the current status and prices of materials will be summarized by insert sheets to the Catalog available at timely intervals from NBS.

Several important changes have been introduced with this edition of the Catalog to improve readability and ease of use, and to reflect a more rational classification of the more than 650 SRM's listed. A subject index, in addition to the listing by SRM number, has been added. In the new system of categories of materials, an initial "3" is used to indicate SRM's certified for chemical composition; and although categories such as "metal-ferrous" and "metal-nonferrous" have been maintained, new sections arranged by element (alphabetically) have been introduced. An initial "4" refers to SRM's certified for one or more physical properties that have been grouped under the traditional subject headings of heat, electricity, radioactivity, etc. Initial "5" is reserved for engineering standards, such as SRM's of rubbers and plastics.

IRON AND STEEL PRODUCTS

To provide iron and steel SRM's of the same nominal composition for a variety of analytical techniques, the

TABLE 1. *Unit of Issue and Price*

SRM	*Type*	*Price*
300 series:	chips, 150 grams sized between 16- and 35-mesh sieves	
*361	AISI 4340	$33
*362	AISI 94B17 (modified)	33
363	Special 1	33
364	Special 2	33
*365	Electrolytic Iron	33
366	Set of 1 each 361, 362, 363, 364, and 365	not established
600 series:	rods, 3.2 mm (⅛ in) in diameter by 51 mm (2 in) long	
*666	Set of 1 each—661–AISI 4340, 665–Electrolytic Iron	40
667	Set of 1 each—662–AISI 94B17 (modified), 663–Special 1	40
668	Set of 1 each 661, 662, 663, 664 (Special 2), and 665	not established
1000 series:	rods, 6.4 mm (¼ in) in diameter by 102 mm (4 in) long	
1095	AISI 4340	33
1096	AISI 94B17 (modified)	33
1097	Special 1	33
1098	Special 2	33
*1099	Electrolytic Iron	33
1089	Set of 1 each 1095, 1096, 1097, 1098, and 1099	not established
1200 series:	disks, 31 mm (1¼ in) in diameter by 19 mm (¾ in) thick	
*1261	AISI 4340	45
*1262	AISI 94B17 (modified)	45
1263	Special 1	45
1264	Special 2	45
*1265	Electrolytic Iron	45
1266	Set of 1 each 1261, 1262, 1263, 1264, and 1265	not established

NBS Office of Standard Reference Materials is preparing 20 individual and six sets of new iron and steel SRM's. The base materials for these SRM's are four steels [AISI type 4340, AISI type 94B17 (modified), and two steels designated Special 1 and 2], and electrolytic iron.

These SRM's will be issued in four different groups—SRM series 300, 600, 1000, and 1200—with five individual SRM's in each series. In the 600 series, however, the SRM's will be sold only in sets of two or five.

Each series will be useful in a different analytical area. The 300-series SRM's are in chip form for use in chemical analysis. The 600-series SRM's are rods designed for microchemical methods of analysis such as electron probe, laser probe, and spark-source mass spectrometry. The 1000-series SRM's are gas-in-metal standards for use in calibrating and evaluating vacuum fusion and neutron activation methods of determining oxygen content. The 1200-series SRM's are disks intended primarily for use in optical emission and x-ray spectrometric analysis. The five 1200-series SRM's will eventually replace eight low-alloy iron and steel SRM's in the 1100 series.

The material for these SRM's was vacuum melted and cast in ingots at the Carpenter Technology Corporation, Reading, Pa., under an NBS contract made possible by a grant from the American Iron and Steel Institute. The ingots were processed by Carpenter Technology Corporation to provide material of the highest possible homogeneity.

Cooperative analyses leading to certification of these SRM's are being performed in various industrial analytical laboratories. Generally, each SRM is analyzed by four industrial laboratories as well as by the Bureau's Analytical Chemistry Division. Chemical analyses for certification were made on composite samples representative of each final shape and size; for certain elements, however, and based on previous experience, only one composite sample was analyzed with the results applied to the other forms of material.

Following NBS analysis of the composition, selected portions of the ingot material were extensively tested for homogeneity in the NBS Analytical Chemistry Division. Only that material meeting a critical evaluation was processed to the final sizes.

At present, three SRM's in both the 300 and 1200 series, one in the 1000 series, and one set of two SRM's in the 600 series have been issued with Provisional Certificates of Analysis. These Certificates list the nominal chemical compositions of the materials together with provisionally certified concentrations for 39 elements. Table 1 gives the type, dimensions, and price[2] of the SRM's. Those marked with an asterisk (*) have already been issued; the others will be announced as soon as they become available.

[1] Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Order by SD Catalog Number for the price indicated.

[2] These SRM's may be purchased for the price indicated from the Office of Standard Reference Materials, Room B312, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234.

STANDARDS AND CALIBRATION

STANDARD FREQUENCY AND TIME BROADCASTS

High-frequency radio stations WWV (Fort Collins, Colo.) and WWVH (Maui, Hawaii) broadcast time signals on the Coordinated Universal Time (UTC) system as coordinated by the Bureau International de l'Heure (BIH), Paris, France. The NBS time scale, UTC(NBS), and the U.S. Naval Observatory time scale, UTC(USNO), are jointly coordinated to within ± 5 microseconds. The UTC pulses occur at intervals that are longer than one coordinate second by 300 parts in 10^{10} during 1971, due to an offset in carrier frequency coordinated by BIH. To maintain the UTC scales in close agreement with the astronomers' time, UT2, phase adjustments are made at 0000 hours Greenwich Mean Time (GMT) on the first day of a month as announced by BIH. *There will be no adjustment made on January 1, 1971.*

The low-frequency radio station WWVB (Fort Collins, Colo.) broadcasts seconds pulses without offset to make available to users the standard of frequency so that absolute frequency comparisons may be made directly, following the Stepped Atomic Time (SAT) system. Step time adjustments of 200 ms are made at 0000 hours GMT on the first day of a month when necessary. BIH announces when such adjustments should be made in the scale to maintain the seconds pulses within about 100 ms of UT2. *There will be no adjustment made on January 1, 1971.*

NBS obtains daily UT2 information from forecasts of extrapolated UT2 clock readings provided by the U.S. Naval Observatory with whom NBS maintains close cooperation.

NSRDS NEWS

The NSRDS was established to make critically evaluated data in the physical sciences available to science and technology on a national basis. The NSRDS is administered and coordinated by the NBS Office of Standard Reference Data.

REPORT ON THE STATUS OF THE NSRDS

NBS Technical Note 553, *Critical Evaluation of Data in the Physical Sciences—A Status Report on the National Standard Reference Data System,*[1] (70 cents, SD Catalog No. C13.46:553), David R. Lide, Jr., Editor, is the latest report outlining the progress of the NBS Office of Standard Reference Data System in administering the program. As the status report notes, the major aim of the program is to provide critically evaluated numerical data to the scientific and technical community in a convenient and accessible form. A second but equally important aim of the NSRDS program has been to provide feedback into the generation of physical data that can raise the general standards of measurement; that is, by communicating the experience gained in evaluating the world output of data in the physical sciences, it is believed that experimental techniques can be advanced and the reliability of physical measurements improved.

Technical Note 553 reports that the NSRDS–NBS Series, which has been the principal outlet for evaluated data compilations and critical reviews produced under the program, has produced 33 titles. In addition, almost 50 other data compilations, bibliographies, and descriptions of data-handling techniques have appeared through other publication channels. Almost 70 000 copies of documents in the NSRDS–NBS Series have been distributed, and significant secondary distribution of the Series' data has been made through reprinting in various handbooks. Despite this impact, many potential users of the output of the program still are unaware of the availability of NSRDS publications.

The NSRDS program was established in 1963 under the general enabling legislation of the National Bureau of Standards. In 1968 the Congress provided specific legislative authority for the program through passage of Public Law 90–396, the Standard Reference Data Act. (The text of the Act is provided in an appendix to Technical Note 553.) Under provisions of this Act, arrangements are being explored for commercial publication of some NSRDS publications nearing completion. Also under provisions of this Act, publications in the NSRDS–NBS Series are being copyrighted.

The technical scope of the NSRDS program is restricted to well-defined physical and chemical properties of substances and systems that are well characterized. Resources are concentrated on intrinsic properties that are clearly defined in terms of accepted physical theory, while properties that depend on arbitrarily defined characteristics of measurement techniques are generally excluded. Also excluded from consideration are materials of uncertain or variable composition. Biological properties and data relating to large natural systems also fall outside the scope of the NSRDS program. The scope of the NSRDS program encompasses seven technical areas: Thermodynamics and transport properties; atomic and molecular data; chemical kinetics; solid state data; nuclear data; colloid and surface properties; and mechanical properties.

This status report provides information on the progress of activities in each of the named technical areas. A review is provided of important developments in each area and is followed by individual progress reports for each data evaluation project supported fully or partially by the Office of Standard Reference Data during the fiscal year 1970. Included are both short-term projects and continuing data centers. A complete list of continuing data centers in the United States that are recognized as part of the national effort in the NSRDS program is given in an appendix. Also, the report provides a full list of publications that have appeared under the auspices of the NSRDS program. Further, this status report also reviews the program's research on data processing by the Data Systems Design Group and notes limited information services available from OSRD.

BIBLIOGRAPHY ON EQUILIBRIUM CRITICAL PHENOMENA IN FLUIDS AND MIXTURES

NBS Special Publication 327, *Equilibrium Critical Phenomena in Fluids and Mixtures: A Comprehensive Bibliography With Key-Word Descriptors,*[1] ($4, SD Catalog No. C13.10:

327), by Stella Michaels, Melville S. Green, and Sigurd Y. Larsen, is intended to include all studies of equilibrium properties of the critical point of liquid-vapor systems and of binary and ternary liquid mixtures published from January 1, 1950, through December 31, 1967. Excluded are general studies that cover the critical region as part of a larger region but do not make a special study of it, simple measurements of critical constants, and compilations of data. A total of 1088 references are listed, in all major scientific languages (except Chinese) in which adequate sources of information were available.

Each paper was analyzed and characterized by key-word descriptors with a primary division as to type of research, i.e., experimental, theoretical, or analytical, being made first. Another primary categorization was according to type of system: liquid-vapor and binary or ternary liquid mixtures. Other descriptors include property measured, theoretical method used, and the chemical name of the substance measured. Approximately 1500 distinct descriptors are used, of which roughly seven to ten are used in characterizing each paper. All entries are cited in English, the original language being shown in brackets. Wherever possible, translations of foreign language documents are also cited. There is an author index as well as a subject index through which all papers described by a given key word can be identified.

KINETIC DATA ON ATOMIC ADDITION REACTIONS

The Office for Scientific and Technical Information of the Department of Education and Science, United Kingdom, has recently awarded a grant to Dr. J. A. Kerr of the University of Birmingham, United Kingdom, for a literature survey of kinetic data on the addition reactions of atoms and free radicals to unsaturated molecules in the gas phase. The survey will follow the lines of the NSRDS series NSRDS–NBS 9, *Tables of Bimolecular Gas Phase Reactions;* NSRDS–NBS 20, *Gas Phase Reaction Kinetics of Neutral Oxygen Species;* and NSRDS–NBS 21, *Kinetic Data on Gas Phase Unimolecular Reactions.* The format of the published data for this project will follow the reports issued by D. L. Baulch of the University of Leeds on High Temperature Reaction Rate Data. Dr. Kerr will also revise and update *Tables of Bimolecular Gas Phase Reactions*, NSRDS–NBS 9. The revision will be in the form of a Supplement and will cover the literature for 1966–1968.

DATA COMPILATIONS OF THE OFFICE OF STANDARD REFERENCE DATA

NBS Technical Note 554, *Annotated Accession List of Data Compilations of the Office of Standard Reference Data*[1] ($1.50, SD Catalog No. C13.46: 554), compiled by Herman M. Weisman and Gertrude B. Sherwood, makes available an annotated list of the holdings in the data file of the Office of Standard Reference Data.

Systematic compilations of data contribute in a fundamental way to the progress of science and technology. Such compilations have been among the basic tools of scientists and engineers throughout the history of technology. Recognizing that knowledge of the items within its collection could be of value to many scientists and engineers, the Office of Standard Reference Data has organized the documents and prepared an annotated accession list to be made available to the technical community. Individuals as well as organizations might be interested in single items in the collection or groupings of them.

The OSRD Library has amassed and organized about 1300 reference data compilations, critical reviews, bibliographies, and other ancillary reference works into a collection that has been judged as one of the most extensive of its kind in the world. The documents are arranged in the following categories: general collections, fundamental particles properties, nuclear properties, atomic and molecular properties, solid state properties, chemical kinetics, colloid and surface properties, mechanical properties, and thermodynamic and transport properties. The compilers have attempted to provide information on the sources of availability for the publications within this list. Annotations are based on author abstracts found in the original documents.

The OSRD does not necessarily vouch for the validity, criticality, or currency of the data within the documents of the list. The documents have been selected on the basis of the judgment by the technical staff of the Office as providing some information or data of a useful and reference nature. An explanation of the classification scheme of the arrangement of the documents in this listing is contained in the Introduction to Technical Note 554.

NEW PUBLICATIONS LIST

The latest NBS List of Publications is No. 68, dated August 1970, from the Chemical Kinetics Information Center, *Chemical Kinetics of Reactions of the Sulfur Oxides, S-Atoms, SH and H_2S: Dissociation, Photolysis and Reactions with H, O, O_2, O_3 and the Nitrogen Oxides.* This is a bibliography that lists research papers on the reaction kinetics of gas phase reactions of the sulfur oxides, sulfur atoms, thiyl (or thiohydroxyl) radical, and hydrogen sulfide with hydrogen atoms, oxygen atoms, hydroxyl radical, molecular oxygen, ozone, nitric oxide, and nitrogen dioxide.

The material is arranged by chemical reaction, and almost 40 reactions are presented. A reaction appears only once, all references to rates, both "forward" and "reverse," being grouped together.

The list is based on the files of the Chemical Kinetics Information Center and an examination of Chemical Abstracts 1962–1970. Most of the papers listed were published since 1962.

Persons in the air pollution field will be interested in this bibliography. It is available without cost from the Chemical Kinetics Information Center, Room B158, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234.

BULLETIN OF THERMODYNAMICS AND THERMOCHEMISTRY

The thirteenth annual issue of the *Bulletin of Thermodynamics and Thermochemistry*, prepared under the auspices of the Commission on Thermodynamics and Thermochemistry of the Division of Physical Chemistry of the International Union of Pure and Applied Chemistry and edited by Edgar F. Westrum, Jr., has recently become available. The prime purpose of the *Bulletin* is to provide an avenue of communication among research scientists in thermodynamics from all countries of the world. It furnishes information about research in progress and about research completed but still unpublished, including papers submitted to journals but not yet in print. Production of the *Bulletin* requires a considerable scientific endeavor by the staff of about 200 laboratories contributing abstracts on their current research, as well as considerable effort on the part of the editors and collaborators in this country, the U.S.S.R., and Japan.

The *Bulletin* has received support from the National Science Foundation and The International Union of Pure and Applied Chemistry, and cooperation from the Office of Standard Reference Data and the Thermodynamics Research Center at Texas A&M University.

The price of the *Bulletin* is $12. Subscriptions and orders for single copies should be addressed to the University of Michigan, Publications Distribution Services, 615 E. University Avenue, Ann Arbor, Mich. 48106. Editorial and related correspondence should be directed to Professor Edgar F. Westrum, Jr., Department of Chemistry, University of Michigan, Ann Arbor, Mich. 48106.

COMPILATION OF X-RAY CROSS SECTIONS

Compilation of X-Ray Cross Sections, UCRL–50174, Sections I, II Revision 1, III, IV, by W. H. McMaster, N. Kerr Del Grande, and J. H. Mallett of Lawrence Radiation Laboratory, Livermore, Calif., and J. H. Hubbell, Director of the NBS X-Ray Attenuation Coefficient Information Center, are tabulations of values of x-ray cross sections derived from critically-evaluated data in the range from 1 keV to 1 MeV. To obtain these values, existing experimental x-ray total cross-section data and theoretical cross-section calculations were surveyed. Coherent scattering, incoherent scattering, photoelectric, and total cross sections are given for 87 elements both in barns/atom and cm^2/g. Miscellaneous data are also given, including the fit coefficients for obtaining scattering and photoelectric cross sections at energies other than those tabulated. The coherent (Rayleigh) scattering cross section and the incoherent (Compton) scattering cross sections were computed. The photoelectric cross sections were obtained by least-squares fitting of experimental data (when the data were both available and reliable), by calculation from theory (in regions where the data were insufficient or unreliable), and by interpolation in regions where neither experimental nor theoretical values were available.

The results of the evaluation, which were based on existing data files at the Lawrence Radiation Laboratory and at the National Bureau of Standards, are described in Section I, presented in graphical and tabular form in Section II, compared with the input data that were used in Section III, and presented at selected wavelengths of most use to x-ray crystallographers in Section IV.

The experimental data, their source, and the weighting values used in constructing the compilation are listed (Section III, Appendix A) to enable the reader to draw his own conclusions concerning the status of experimental measurements over any energy range of interest and to determine regions where additional measurements are necessary. As they are reported, new experimental data can be compared with this listing of approximately 10 000 cross-section values from 84 data sources. A related critically evaluated compilation extending the energy coverage for 23 elements is NSRDS–NBS 29, *Photon Cross Sections, Attenuation Coefficients, and Energy Absorption Coefficients From 10 keV to 100 GeV*[1] (75 cents, SD Catalog No. C13.48: 29) by J. H. Hubbell.

The compilation UCRL–50174 (Sec. I, 18 pp.; Sec. II Revision 1, 353 pp.; Sec. III, 194 pp.; Sec. IV, 40 pp.), completed January 1970, may be obtained through the National Technical Information Service (formerly the Clearinghouse for Federal Scientific and Technical Information), Springfield, Va. 22151. The price for printed copy is $12 complete ($3 per single section) and for microfiche is $2.60 complete (65 cents per single section). Section II Revision 1 is available in ENDF/B-format as the 1-keV to 1-MeV portion of a 1-keV to 100-MeV tape (tape DLC–7) from the Radiation Shielding Information Center (D. K. Trubey, Director), Oak Ridge National Laboratory, Oak Ridge, Tenn. 37830. In addition, the ENDF/B tape is available to United States users through the National Neutron Cross Section Center (Attention: Dr. Ben Magurno), Brookhaven National Laboratory, Upton, L.I., N.Y. 11973, and to the Organization for Economic Cooperation and Development (O.E.C.D.)-affiliated European users through the European Nuclear Energy Agency (E.N.E.A.), Neutron Data Compilation Centre, B. P. Baker Hall, No. 9, 91 Gif-sur-Yvette (F. et O.), France.

[1] Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for the price indicated.

CONFERENCE & PUBLICATION *Briefs*

SCHEDULED NBS-SPONSORED CONFERENCES

Each year NBS sponsors a number of conferences covering a broad range of topics in science and technology. The conferences listed below are either sponsored or cosponsored by NBS and will be held at the Bureau's Gaithersburg, Md., facility unless otherwise indicated. These conferences are open to all interested persons unless specifically noted. If no other address is given, inquiries should be sent to the person indicated below in care of Special Activities Section, Room A600, Administration Building, National Bureau of Standards, Washington, D.C. 20234.

Second National Conference on Roofing Technology. Mar. 22–23. Cosponsor: National Roofing Contractors Association. Contact: William C. Cullen (NBS Building Research Division).

Flow—Its Measurement and Control in Science and Industry. May 10–14. Cosponsors: American Institute of Physics; American Society of Mechanical Engineers; Instrument Society of America. Contact: V. J. Giardina, Instrument Society of America, 400 Stanwix Street, Pittsburgh, Pa. 15222. To be held in Pittsburgh, Pa.

Fourth Joint Meeting of Operations Researchers. May 24–26. Cosponsors: College on Logistics of the Institute for Management Sciences (TIMS); Mathematical Society of America; American Society for Cybernetics; American Society for Public Administration; Association for Computing Machinery; Operations Research Society of America. Contact: Lloyd Burden (NBS Technical Analysis Division).

Summer Symposium in Analytical Chemistry. June 16–18. Cosponsor: American Chemical Society (Division of Analytical Chemistry). Contact: R. A. Durst (NBS Analytical Chemistry Division).

NBS Measurement Seminars, 1971 Series. Two- to four-day courses on measurement and calibration problems. Attendance limited. See September 1970 *Technical News Bulletin* for detailed information.

SURVEY OF MICROMANOMETERS

Micromanometers are used to measure small gas pressures or differentials, from about 0.001 to 50 mm of mercury (0.13 to 6650 N/m^2). NBS Monograph 114, *Survey of Micromanometers* [1] by W. G. Brombacher (60 cents, SD Catalog No. C13.44:114), describes the measuring element and method of measurement for micromanometers, based on the literature from 1900 to 1968, and summarizes their performance.

More than half of this monograph is devoted to U-tube micromanometers and diaphragm-capacitance gages. Other instruments described are gas column manometers, elastic element micromanometers, piston gages, vane gages, and centrifugal micromanometers. Calibration and measurement techniques are described, and schematic diagrams of about 70 instruments and a list of references are included.

RADIOACTIVITY CALIBRATION STANDARDS

Radioactivity Calibration Standards, NBS Special Publication 331 [1] ($1.25, SD Catalog No. C13.10:331), edited by W. B. Mann and S. B. Garfinkel, contains the proceedings of a special session of the International Conference of the American Nuclear Society Meeting on the Constructive Uses of Atomic Energy.

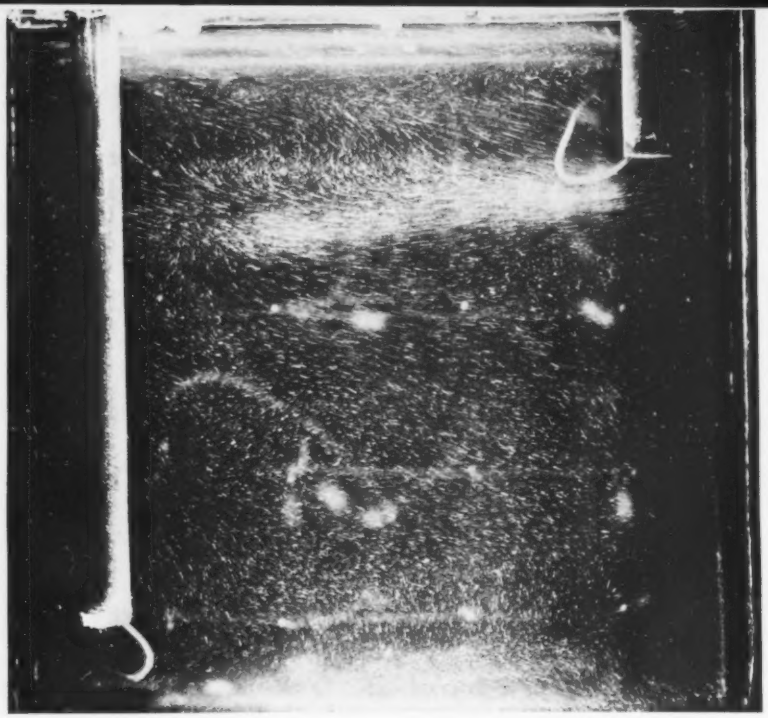
The collection of eight papers presented at the session describes experimental procedures and methods used in nine international radioactivity standardization laboratories. Among the special topics discussed are: the possibility of attaining accuracies of the order of 0.01 percent; the desirability of carrying out international consistency checks for new gamma-ray, solution standards of the same radionuclide issued over a period of time, using a $4\pi\gamma$ ionization chamber; the validity of radioactivity standards; and an analogue method of liquid-scintillation counting.

PRESTRESSED CONCRETE COMPOSITE TEE-BEAMS

Flexural Behavior of Prestressed Concrete Composite Tee-Beams, by J. O. Bryson and E. F. Carpenter, NBS Building Science Series 31 (25 cents, SD Catalog No. C13.29/2:31), is a report [1] on a series of prestressed Tee-beams constructed by the split-beam technique. The split-beam technique requires that the tensile and compressive areas of the beam's cross section be constructed separately to restrict the precompression to the tensile section. The Tee-beams were tested to failure to study their behavior and ultimate strength and to compare their performance with those of conventional monolithic prestressed beams. The variables investigated included percentage of prestressing steel, strength of concrete in the compressive element of the split-beam, manner of prestressing, and web reinforcement.

Composite split-beams were found to behave similarly to the monolithically constructed beams on the basis of flexural response and ultimate load. The strength of the concrete for the compressive element could be reduced within limits from that required for the prestressed element without sacrificing ultimate load capacity. Also, the required percentage of reinforcing steel was less for the split-beam than for the conventional beams.

[1] Order by SD Catalog Number for the price indicated from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.



The flow pattern of air currents in a room is simulated by trace particles (aluminum dust) and water at high temperature and pressure. In this model, water is circulated by the two vertical pipes and by means of temperature differences between the walls of the model.

MODEL SIMULATES CONVECTION AND VENTILATION IN ROOMS

AN EXPERIMENTAL TECHNIQUE has been developed at the Institute for Applied Technology to study natural convection and ventilation in a room. In this work [1] by E. M. Barber, D. A. Bettge, and F. J. Powell, a small-scale model is used to simulate the actual room; high-temperature water simulates air, and time-exposure photographs of trace particles suspended in the water reveal convection patterns. A better understanding of convection should be of assistance in optimizing the locations and performance of heating, cooling, and ventilation devices in a room. The Office of Civil Defense, concerned with obtaining better design information on the distribution of air and temperature within naturally ventilated shelters, cosponsored the study.

The modeling technique appears to have excellent possibilities for the study of air moving at speeds on the order of 0 to 10 ft/s—speeds at which it is very difficult to detect flow by means of air/smoke mixtures. Possible applications of the technique include the study of air flow between rooms, and between floors of a building, and the design of chimneys, chemical fume exhaust hoods, and air curtain systems.

Previous studies [2] have shown that the parameters governing dynamic similarity for natural convection in rectangular enclosures are the Grashof and Prandtl numbers of the fluid, and the dimensions of the enclosures. After considering many fluids for use as working fluids, water at high temperature and pressure was found to be dynamically similar to air at room temperature.

The model used in the study has a size ratio of 1: 20 to that of the full-scaled enclosure simulated. The exterior walls of the model are equipped with serpentine coils carrying heated water to permit temperature control of the surfaces. The temperature level of each wall is controlled independently by means of separate heat exchangers.

The tests were carried out with 250 °F water held at 55 psi to suppress boiling. For each experiment temperatures were raised to the desired level and allowed to reach a steady-state condition. Aluminum dust was then injected into the modeling area. After initial disturbances caused by introducing the tracer had subsided, light, supplied by aircraft runway lights, was adjusted to the proper intensity, and time-exposure photographs were taken. From trace patterns on the photographs and the known exposure duration, the direction and velocity of the flow at any point and the overall convection pattern within the modeling area were determined. Motion pictures are also being made of convection in the model. These are of great assistance in understanding the nature of room convection.

The model is constructed of steel and has a 1-inch-thick glass viewing port to withstand the required pressures. Depending on the experiment, water is either circulated by natural ventilation or convection is maintained by means of temperature differences between walls.

[1] Barber, E. M., Bettge, D. A., and Powell, F. J., Development of a modeling technique for evaluation of natural convection and ventilation in rooms, ASHRAE Bull. (to be published).

[2] Wilkes, J. O., The Finite Difference Computation of Natural Convection in an Enclosed Rectangular Cavity, Ph. D. Thesis, University of Michigan, 1963 (University Microfilms, Inc., Ann Arbor, Mich.).

NBS OBTAINS NEW f-VALUES FOR IRON

ASTRONOMERS ARE GREATLY INTERESTED in accurate determinations of the abundance of solar iron, determinations that are of critical importance in developing models of the solar atmosphere. They have been puzzled by determinations that seemed to give a much smaller iron abundance in the sun's photosphere than in the corona. The accuracy in determining such abundances is critically dependent upon a basic atomic characteristic—the atomic oscillator strengths, or f-values, of the element in question. Gross deviations between a few newly measured Fe I f-values in the literature and older, widely accepted comprehensive data tables led atomic physicists J. M. Bridges and W. L. Wiese of the Institute for Basic Standards to remeasure the f-values for iron on a comprehensive scale in hope of resolving this discrepancy. Their results [1] are the first to tie together all the recent consistent literature data that closely agree with the new NBS results. The new NBS values also show a strong systematic disagreement with the older data by factors up to 20. The result is that astronomers are increasing their estimate of the solar photospheric iron abundance by about a factor of 10, thus removing the long standing discrepancy between the abundances of coronal and photospheric iron. Partial support for the project was received from the Advanced Research Projects Agency, Strategic Technology Office of the Department of Defense.

NBS researchers modified a plasma arc source, stabilizing the light intensity which provided data with much higher accuracy than had been attained in previous measurements. The arc source is composed of ten circular metal plates separated by insulators, with a 5 mm diameter hole through the center. Quartz windows permit observing the plasma from either the side or the end direction. Tubes leading into the arc carry water or air for cooling the metal plates, or admit gases to the interior where the plasma column is generated.

Iron is introduced into the plasma by flowing argon over ferric chloride in a resistively heated tube. The amount of iron vapor being carried is directly proportional to the argon flow rate, which, in turn, is controlled by a feedback signal from a photoelectric spectrometer holding one spectral line at a constant intensity. A second spectrometer photoelectrically scans the entire spectrum, producing graphic and digital records of the intensity of each spectral line. The intensities are calibrated with a tungsten ribbon lamp and combined with spectroscopic temperature determinations to derive the oscillator strengths.

[1] For further details, see Bridges, J. M., and Wiese, W. L., The oscillator strength scale for Fe I, Astrophys. J. Letters **161**, L71 (1970).

The modified arc discharge lamp (the core of the plasma arc source) is shown here with its designer, J. Mervin Bridges. The large resistively wired tubes extend horizontally—one being held by Dr. Bridges.

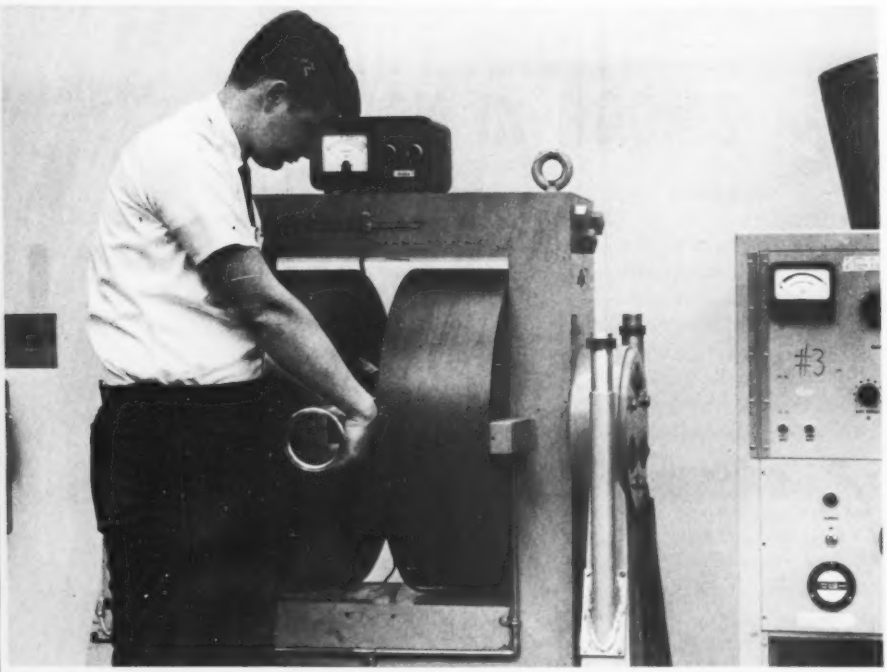
POSTDOCTORAL RESEARCH ASSOCIATESHIPS AWARDED

SIXTEEN MEN AND WOMEN have been awarded Postdoctoral Research Associateships for 1970–71 at the National Bureau of Standards. The Postdoctoral Research Program enables young scientists showing outstanding capabilities as potential leaders in science to advance their training by working with a senior member of the scientific staff on Bureau-sponsored research in their chosen field of study. The Bureau and the National Academy of Sciences–National Research Council initiated the program, now incorporated in 13 other Government laboratories.* The postdoctoral programs provide not only for the training of young scientists, but also for a "cross-fertilization" of ideas, benefiting both the research organization and the scientist's future employer.

In the 16 years of NBS participation in the program, 187 men and women have been selected as Postdoctoral Research Associates at NBS. Of these, 61 have accepted permanent positions as NBS staff members.

Students applying for the NRC–NBS associateships must be United States citizens and must have completed the requirements for a doctorate in one of the physical sciences. In addition they must have received their Ph.D. degrees by the time they begin the associateship. This year the NBS committee to direct and evaluate the applications for associateships was composed of Dr. Shirleigh Silverman, Chairman; Dr. Randall S. Caswell; Dr. Robert J. Corruccini; Dr. Richard H. Kropschot; Mrs. Ethel C. Marden; Dr. Wille E. Phillips; and Dr. John B. Wachtman, Jr.

The following is a brief summary of the proposed programs of each of the 16 appointed Postdoctoral Research Associates for 1970–71.



Max A. Haney checks the size of part of the vacuum system in building an ion cyclotron resonance mass spectrometer to accurately measure rate constants of ion molecule reactions.

GERALD B. COHEN (Carnegie–Mellon University) expects to provide improved techniques for reducing tire wear by first developing an adequate model, based on the thermodynamic and mechanical properties of rubber, to explain tire wear. (Adviser: F. C. Brenner, Washington, D.C.)

NORDULF W. G. DEBYE (State University of New York at Albany) will investigate the origin of the metal-ligand quadrupole interactions in organotin compounds by the techniques of nuclear quadrupole resonance and Mössbauer spectroscopy. The study will provide new insight into the bonding and stereochemistry of metal-coordination complexes. (Advisers: J. R. DeVoe and M. Linzer, Gaithersburg)

DOUGLAS L. FRANZEN (University of Minnesota). The use of gas dynamic principles for flowing molecular laser systems has significantly increased the efficiency and reduced the size of chemical and electrically excited molecular lasers. Dr. Franzen

will employ gas dynamic techniques to investigate infrared molecular water vapor lasers. (Adviser: H. S. Boyne, Boulder)

JOHN W. GRAMLICH (University of Hawaii). The precise measurement of the isotopic ratio of rhenium-185 to rhenium-187 will provide data for the calculation of an accurate atomic weight for the element. When this is completed the method is potentially useful for determination of the "age" of certain ore deposits which should aid in an understanding of their genesis. (Adviser: I. L. Barnes, Gaithersburg)

MAX A. HANEY (Stanford University) proposes to build an ion cyclotron resonance mass spectrometer which is capable of accurately measuring rate constants of ion molecule reactions. The instrument will be used to investigate the mechanism of charge exchange reactions in the gas phase. (Adviser: T. C. Farrar, Gaithersburg)

ANDREW KALDOR (Cornell University) will study molecular relaxation by first using a laser to excite molecules to a vibrational state; the relaxation of the excited molecule can then be followed by observing the fluorescence emitted by various lower vibrational states. These measurements will provide information on how intramolecular energy transfer occurs in solids or liquids. Dr. Kaldor plans to simplify the system and sharpen the absorption and fluorescence bands by isolating the molecules in a matrix at low temperatures. (Adviser: A. G. Maki, Gaithersburg)

GEORGE E. KELLY (Northwestern University). Dr. Kelly will be attempting to develop a new theory of homogeneous nucleation (cluster formation) which, if successful, will correct existing theories and which will be able to be verified experimentally. This work could ultimately lead to a better understanding of cloud and fog formation (and hence improved weather prediction) through a better understanding of the kinetics of the formation of molecular clusters. (Advisers: M. Klein and J. M. H. L. Sengers, Gaithersburg)

DONALD R. LEHMAN (George Washington University). Extensive experimental and theoretical effort has been devoted to the quantitative description of the nuclear two-body forces. In contrast, rather little is known about the more complicated three-body forces. Dr. Lehman will examine three-body interactions employing low-energy inelastic electron scattering from ^{3}He and ^{3}H in an attempt to answer several questions that might result in developing a theoretical model of three-body interactions. (Adviser: M. Danos, Gaithersburg)

FRANK J. LOVAS (University of California, Berkeley) will pursue the continuing systematic investigations of molecules present in high-temperature gases by microwave absorption spectroscopy to yield such basic molecular properties as rotational constants, hyperfine structure constants, electric dipole moments, and molecular geometry. (Adviser: D. R. Lide, Jr., Gaithersburg)

MICHAEL A. MARCHETTI (Georgetown University). Ozone, an important species in the upper atmosphere, remains relatively unexplored. Dr. Marchetti's study aims at obtaining accurate wave functions of the ozone molecule in order to evaluate transition moments. (Adviser: F. H. Mies, Gaithersburg)

BRUCE W. MORRISSEY (Rensselaer Polytechnic Institute). A serious obstacle in medical technology is the adverse reaction of blood with artificial materials used in the cardiovascular system. The blood-material interface problem relates to the interaction of blood components, such as albumin and fibrinogen, with the surfaces of materials used as artificial arteries and organs. As an example of his proposed research, Dr. Morrissey will investigate the interaction and denaturation of blood with various material surfaces. (Adviser: R. R. Stromberg, Gaithersburg)

DONALD W. REGULA (Wayne State University). Liquids flowing through pipes can under certain conditions experience significantly lower flow resistance upon addition of very small amounts of certain long-chain polymers. This drag reduction phenomenon could favorably affect fluid transport in petroleum pipelines and in fire-fighting water hoses, for example. Dr. Regula will experimentally investigate the mechanical degradation of these polymers. Such data are needed for the design of equipment to handle these problems. (Adviser: G. Kulin, Gaithersburg)

MICHAEL WAYNE SCHUYLER (Indiana University) plans to investigate electronic relaxation between vibronic levels in polyatomic molecules such as benzene. Experimental techniques will involve studying fluorescence emission following excitation to specific vibronic states with a tunable laser. Information gained from these studies will lead to better understanding of the interactions between vibronic levels in intermediate sized molecules. (Adviser: R. A. Keller, Gaithersburg)

MARK E. SHEINGORN (University of Wisconsin) will be investigating conditions that regions in the complex plane must satisfy in order that polynomial approximation of analytic functions using "integral norms" be possible. Such problems are of both direct and theoretical concern to NBS, and the results of this research are expected to be of use in the general area of polynomial approximation of functions. (Adviser: M. Newman, Gaithersburg)

CARROLL A. SHELTON (Univer-

sity of Pittsburgh). Although boron phosphates offer a great potential for scientific and commercial use, their reactions with glass containers and air have discouraged scientists from obtaining much experimental information about them. Dr. Shelton will attempt to overcome these difficulties and look at the crystalline structure of some boron phosphates using x-ray crystallographic techniques. (Adviser: S. Block, Gaithersburg)

SIEGFRIED TREU (University of Pittsburgh) foresees that man's capabilities in information processing can be greatly increased through developments in man-computer communication. In his proposed research Dr. Treu will attempt to improve the communication channels between men and machines by making them more flexible and tailored to the users' varying needs. Message length and frequency of message repetition, and the possibility of activating more than one of the users' senses (e.g., sight and hearing) are also to be studied as a possibility in providing more effective information transmission. (Advisers: C. T. Meadow and T. Pyke, Gaithersburg)

*Agricultural Research Service, Air Force Systems Command, Bureau of Mines, Environmental Science Services Administration, Food and Drug Administration, Fort Detrick, Naval Bureau of Medicine and Surgery, Naval Electronics Laboratory Center, Naval Ordnance Laboratory, Naval Postgraduate School, Naval Research Laboratory, Naval Weapons Center, and U.S. Geological Survey.

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